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The Occurrence of Iron Sulfide Minerals and Their Indication Significance of Mineralization Process in the Panzhihua Fe-Ti-V Oxide Deposit, SW China

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The Panzhihua layered mafic intrusion which reserves world level Fe-Ti-V oxide deposit is located in the Emeishan large igneous province, SW China. According to the latest research of spatial location, formation time (Zhong, et al, 2006; Zhou, et al, 2002) and material sources(Ai, et al, 2006), the genesis of Panzhihua layered rock and associated Fe-Ti-V oxide deposit has been attributed to Emeishan mantle plume. Therefore, to further investigate the genesis of the Panzhihua Fe-Ti-V oxide deposit will contribute to deeply understand the mantle plume activity.

Although many research efforts have been made in petrology, geophysics, geochemistry, geochronology and other fields, there are still some different views on the genesis of the Panzhihua intrusion and associated ore deposit.

In the past, the research of iron sulfide minerals in the ore deposits associated with mafic and ultramafic rocks mainly focuses on Cu-Ni sulfide deposits. The iron sulfide minerals can be used as indications of the metallogenic process of the Cu-Ni sulfide deposits well. However, the study of iron sulfide minerals in the Fe-Ti-V oxide deposits was rarely reported. In this work, we explored the information of genesis of iron sulfide minerals in the Panzhihua Fe-Ti-V oxide deposit, in the hope of revealing the law of variation of physical and chemical conditions during the metallogenic process of mantle plume, and getting the genetic mineralogy evidence of magma evolution.

By optical microscopy and field emission scanning electron microscope, we carried out a detailed petrographic observation. In the deposit, over 90% content of iron sulfide minerals is pyrrhotite, which followed by pyrite.

There are mainly four main occurrences of pyrrhotite. They are granular, droplet, leaf-shaped and veinlet respectively. Among them, the xenomorphic granular ones, accounting for over 80% pyrrhotite, distribute among the interstitial of other minerals. And they are considered as the products of the late fractionation of magma. The sub-rounded or rounded droplet ones, the particle and amount of which are both small, are wrapped in the silicate minerals or iron titanium oxide minerals. And they are considered as the products of the early fractionation of magma. The leaf-shaped ones are closely associated with alteration minerals, and sometimes the alterations are complete and form the pseudomorph of silicate minerals. The veinlet ones occurred as vein aggregates are in a very small quantity, and fill in the cracks of other minerals.

There are mainly two occurrences of pyrite. The first one is subhedral or anhedral granular aggregate distributed among the interstitial of other minerals. The second one occurs as irregular vein, stockwork, or veinlet.

The results of observation showed that, in the early fractionation of magmas, the sulfide droplets isolated from magmatic melt were wrapped by pyroxene crystals or iron titanium oxide minerals which formed simultaneously. Due to the low sulfur fugacity of the whole magma, the content of sulfur was not enough to form pyrite. At this stage, the iron sulfide minerals were mainly droplet pyrrhotite, but not droplet pyrite. In some iron sulfide

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phase wrapped by magnetite, we even found troilite which is a low sulfur member of iron sulfide minerals. In the late fractionation of magma, with the large amount of iron titanium oxide crystalized, the oxygen fugacity reduced and the sulfur fugacity relatively elevated. The sulfide melt crystalized as granular pyrrhotite and pyrite in the interstitial among silicate minerals and iron titanium oxide minerals. At the magmatic hydrothermal stage, the sulfur fugacity elevated, and the hydrothermal fluids crystalized as leaf-shaped and stockwork pyrrhotite and stockwork pyrite in the cracks of silicate minerals.

In conclusion, the occurrence of iron sulfide minerals and the mineral paragenetic association can qualitatively express the changes of the physical and chemical conditions during the metallogenic process, and provide the basis for deeper understanding of mantle plume activity.

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